

Radiographic Features of Knee Osteoarthritis: A Literature Review

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Knee osteoarthritis is a degenerative joint disease that commonly causes chronic knee pain, limited mobility, and reduced quality of life in older adults. Conventional radiography (X-ray) remains the primary modality for initial evaluation due to its wide availability, cost-effectiveness, and ability to demonstrate characteristic structural changes such as joint space narrowing, osteophyte formation, subchondral sclerosis and cysts, and articular deformities. This literature review analyzed 20 national and international articles published between 2020 and 2025, retrieved from PubMed, ScienceDirect, Google Scholar, and Garuda using the PRISMA selection method. The findings indicate that appropriate examination techniques, particularly anteroposterior weight-bearing, lateral, and skyline projections, significantly influence the accuracy of radiological interpretation, while the Kellgren–Lawrence system remains the standard for grading disease severity. Radiography plays an essential role in early intervention planning, emergency department triage, and orthopedic referral, with additional modalities such as MRI and ultrasonography used to detect soft tissue abnormalities or early changes not yet visible on X-ray; moreover, emerging applications of deep learning and radiomics show promise in improving assessment consistency and predicting disease progression.

Keywords: Osteoarthritis Genu, Radiografi, Joint Space Narrowing, Osteofit.

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1. Introduction

Knee osteoarthritis (OA) is a chronic disease with multifactorial causes that affects all structures of the knee joint and represents the most common site of OA occurrence. Its prevalence increases with advancing age, excess body weight, and lifestyle changes, making it a major public health issue worldwide. To reduce the burden of this disease, early detection and more precise assessment of joint structures are required (Geng, 2023). According to Maulidya cited in Saputri (2024), osteoarthritis is a progressive disease that develops slowly and is characterized by metabolic and biochemical changes, as well as alterations in cartilage and surrounding tissues, ultimately leading to impaired joint function.

In clinical practice, imaging techniques play a crucial role in establishing the diagnosis and evaluating disease progression. Although various modalities such as magnetic resonance imaging (MRI) and ultrasonography are available, conventional radiography (X-ray) remains the most commonly used initial examination (Demehri et al., 2023). This is because radiography is easily accessible, relatively affordable, rapid, and capable of demonstrating characteristic bony and joint structural changes associated with OA (Piccolo et al., 2023). Therefore, radiography is typically the first-line examination when patients present with symptoms such as knee pain, stiffness, or limited range of motion.

However, radiographic findings are highly influenced by examination techniques, particularly patient positioning, selected projections, and the expertise of medical personnel in image interpretation. Studies in Indonesia have shown that the use of appropriate projections, such as anteroposterior (AP) weight-bearing,

erect lateral, and, in certain conditions, additional projections such as skyline views, provides better visualization of the knee joint and greater sensitivity in detecting OA-related changes compared to supine or non-weight-bearing projections. Consequently, standardization of radiographic techniques is essential in the evaluation of knee osteoarthritis.

Common radiographic findings in OA include osteophyte formation at joint margins, joint space narrowing, subchondral sclerosis, subchondral cysts, and alterations in articular surface contour. For severity assessment, grading systems such as the Kellgren–Lawrence (K–L) scale remain the standard reference in both research and clinical practice (Piccolo et al., 2023; Demehri et al., 2023). Nevertheless, radiographic severity does not always correlate with patients' clinical symptoms, as radiography primarily evaluates bony changes, while pain and stiffness are often related to cartilage damage, synovial inflammation, or other soft tissue abnormalities (Favreau et al., 2025).

The limitations of radiography in identifying early cartilage lesions, subchondral changes, and soft tissue abnormalities necessitate the use of additional examinations such as ultrasonography or MRI, particularly when radiographic findings are inconsistent with clinical complaints. Recent studies suggest that the use of multiple imaging modalities can improve diagnostic accuracy, especially in early-stage or atypical OA cases, thereby enabling earlier intervention (Piccolo et al., 2023; Favreau et al., 2025). In Indonesia, the selection of imaging modalities and examination techniques has also been highlighted in the literature, considering disparities in facilities and available resources across regions, which require radiological practices to be adapted to local conditions (Yuslila, 2025).

Technological advances have further driven developments in OA imaging. Recent studies utilizing deep learning (DL) and radiomics approaches applied to knee radiographs have demonstrated significant potential for automating severity grading, detecting subtle changes, and predicting OA progression (Xie et al., 2025). These artificial intelligence–based approaches may reduce inter-radiologist variability and enhance reporting consistency across healthcare facilities, including high-volume hospitals (Piccolo et al., 2023; Demehri et al., 2023). Nevertheless, further validation and adaptation to local population characteristics are required before widespread implementation.

In Indonesia, several studies have examined the radiographic characteristics of patients with knee osteoarthritis, their associations with risk factors such as body mass index, and their relationships with clinical findings. These studies indicate that knee OA represents a significant health problem in the community. This underscores the relevance of discussing “Radiographic Features of Knee Osteoarthritis” within the national healthcare context, particularly in relation to the development of appropriate radiographic protocols and the harmonization of local practices with international standards (Yuslila, 2025; Aisyah, 2025).

Previous studies conducted at Wahidin Sudirohusodo Regional Hospital in Makassar reported a significant association between radiographic OA severity and body mass index with the level of pain experienced by patients. Similar findings were observed in a study at Kendari City Regional Hospital among orthopedic outpatient clinic patients, which demonstrated a significant correlation between radiographic grading and pain intensity in individuals with knee osteoarthritis (Setiyani, 2023). However, other studies have reported contrasting results, indicating no significant relationship between pain severity and radiographic OA grading.

Given the high burden of knee OA, the need for accurate early diagnosis, the role of radiography as an initial examination, the limitations of conventional techniques, and the potential of modern imaging technologies, a comprehensive review of “Radiographic Features of Knee Osteoarthritis” is critically important. This dis-

discussion is expected to clarify best radiographic practices, enhance early detection, and support more effective OA management in accordance with the conditions of healthcare services in Indonesia and ongoing global developments.

2. Methods

This study employed a systematic literature review design using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) approach to analyze scientific evidence related to radiographic features of knee osteoarthritis (OA), including radiographic characteristics, examination techniques, and diagnostic accuracy based on recent radiological findings. Data sources were obtained from various national and international journal databases, including PubMed, ScienceDirect, SpringerLink, Wiley, Hindawi, MDPI, Google Scholar, Garuda, and Neliti, covering publications from 2020 to 2025. The literature search was conducted using the keywords “knee osteoarthritis radiography” OR “osteoarthritis genu X-ray findings” OR “Kellgren–Lawrence grading” OR “AP weight-bearing radiographic view.”

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
1. Original research articles, systematic reviews, or case reports that discuss radiographic examination in knee osteoarthritis.	Articles were excluded if they:
2. Published in English or Indonesian.	1. Articles that primarily focus on other imaging modalities without presenting radiographic data.
3. Publication period between 2020 and 2025.	2. Animal or laboratory-based studies.
4. Articles with full-text availability	3. Articles focusing on osteoarthritis affecting joints other than the knee.
	4. Articles without full-text availability or those presenting only abstracts

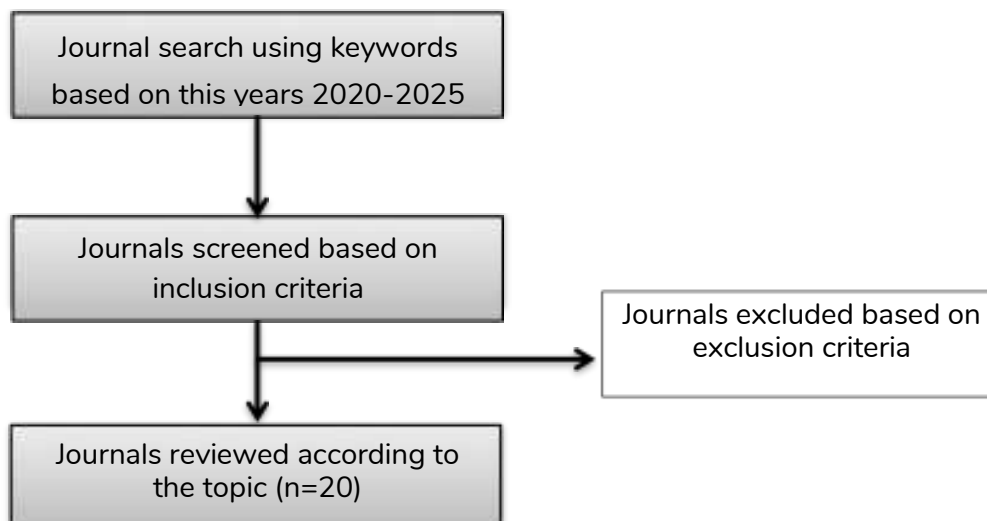


Figure 1. PRISMA Chart

3. Results

Table 2 summarizes the characteristics of studies included in this literature review on radiographic features of knee osteoarthritis, covering radiographic findings, examination techniques, and diagnostic assessment.

Table 2. Table Literature Review

Source No.	Source (Author, Year)	Topic/Etiology of Knee OA	Initial Diagnosis (Radiography/Technique)	Initial Intervention Based on Radiographic Findings	ED / ICU Relevance	Journal Type/Access	Conclusion
1.	Piccolo et al. (2023)	Degenerative knee OA related to aging and joint load	X-ray AP weight-bearing, lateral, skyline; AP weight-bearing most accurate for detecting joint space narrowing (JSN)	X-ray enables rapid differentiation between OA and traumatic conditions	Rapid differentiation of OA versus trauma in the emergency department	Narrative review	AP weight-bearing, lateral, and skyline X-ray views are the most accurate techniques for detecting joint space narrowing (JSN) and degenerative changes in knee osteoarthritis.
2.	Li W. et al., 2024.	Degenerative knee OA with radiomics analysis	X-ray AP and lateral views with radiomic feature analysis	OA grading to support treatment planning	Radiomics accelerates X-ray interpretation in the emergency department	Original research	AP and lateral radiographs can be analyzed using radiomics to identify OA severity in greater detail through extraction of JSN, osteophyte, and sclerosis features.
3.	Langworthy M. et al., 2024	Pathophysiology of knee osteoarthritis	X-ray AP weight-bearing as the initial standard	Conservative therapy based on Kellgren–Lawrence grading	Important for rapid screening of knee pain	Clinical review	AP weight-bearing X-ray remains the standard initial radiographic view for demonstrating structural OA changes, such as osteophyte formation and joint space narrowing.

No.	Source (Author, Year)	Topic/Etiology of Knee OA	Initial Diagnosis (Radiography/Technique)	Initial Intervention Based on Radiographic Findings	ED / ICU Relevance	Journal Type/Access	Conclusion
4.	Pi SW et al., 2023	Knee joint degeneration and automated Kellgren–Lawrence (KL) grading	AP X-ray for automated classification	Treatment decisions based on automated KL grading	Facilitates emergency department triage	Facilitates emergency department triage	P X-ray can be used for automated Kellgren–Lawrence (KL) classification by recognizing key radiographic features, including osteophytes, joint space narrowing (JSN), subchondral sclerosis, and joint deformities.
5.	Shinde M. et al., 2024	OA related to aging, body mass index, and activity load	AP weight-bearing X-ray for KL grading and JSN assessment	Pain management according to radiographic grade	Rapid identification in patients with acute knee pain	Cross-sectional study	AP weight-bearing radiographic findings demonstrate associations between age, body mass index, and activity load with OA severity through visualization of joint space narrowing and osteophyte formation.
6.	Jarraya M. et al., 2024 (OARSI Year in Review)	Structural changes in knee osteoarthritis	AP and lateral X-ray as initial modalities	Conservative management; MRI only when X-ray findings are inconclusive	Screening and fracture rule-out in the emergency department	Narrative review (OARSI journal)	AP and lateral X-ray remain the primary examinations for identifying structural OA changes such as subchondral sclerosis, osteophytes, and joint deformities; MRI is reserved for cases with inconclusive X-ray findings.
7.	Vaattova ara E. et al., 2025	Multifactorial OA and disease progression	AP X-ray for AI-based KL grading	Patient education and monitoring of disease progression	AI improves reporting speed in the emergency department	Original research	AI applied to AP X-ray improves the consistency of Kellgren–Lawrence grading by identifying core radiographic features of OA, including osteophytes, joint space narrowing (JSN), and changes in joint contour.

No.	Source (Author, Year)	Topic/Etiology of Knee OA	Initial Diagnosis (Radiography/Technique)	Initial Intervention Based on Radiographic Findings	ED / ICU Relevance	Journal Type/Access	Conclusion
8.	Sekiya, 2023	Chronic degenerative knee OA	AP X-ray for KL classification	Conservative therapy based on KL grading	Useful for standardizing radiographic reporting in large hospitals	Original research	AP X-ray-based KL classification confirms that radiographic features of knee OA include joint space narrowing, marginal osteophytes, and articular deformities.
9.	Thomas KA et al., 2020	Degenerative OA and convolutional neural networks (CNN)	AP X-ray for automated grading	Orthopedic referral when KL ≥ 3	Assists emergency physicians in rapid decision-making	Original research (RSNA/RAI)	CNNs are capable of automatically assessing AP X-ray images by recognizing OA patterns such as osteophytes, joint space narrowing, and subchondral sclerosis.
10.	Nasef D. et al., 2024	Kellgren–Lawrence grading using deep learning	AP X-ray with preprocessing techniques	Objective diagnostic confirmation	Accelerates radiology workflow in the emergency department	Review / Original research (MDPI)	Deep learning applied to AP X-ray improves the accuracy of radiographic OA assessment through digital identification of joint space narrowing, osteophytes, and subchondral changes.
11.	Angelone F. et al., 2025	Long-term progression of knee OA	AP X-ray analyzed using radiomics	Preventive interventions to slow disease progression	Radiomics enables early OA detection in the emergency department	Original / methodological study (Springer)	Radiomics applied to AP X-ray can detect early-stage OA through analysis of bone texture and joint space features that are not yet clearly visible on conventional visual assessment.
12.	D’Agostino V. et al., 2024	Knee OA and inflammatory evaluation	X-ray as the baseline examination	Intra-articular injection when indicated after X-ray confirmation	Ultrasonography complements ED evaluation following X-ray	Review	X-ray remains the fundamental imaging modality for evaluating knee OA, demonstrating structural changes such as osteophytes and

No.	Source (Author, Year)	Topic/Etiology of Knee OA	Initial Diagnosis (Radiography/Technique)	Initial Intervention Based on Radiographic Findings	ED / ICU Relevance	Journal Type/Access	Conclusion
							subchondral sclerosis, while ultrasonography serves as an adjunct modality.
13.	Demehri et al., 2023	Degenerative features of knee OA	AP weight-bearing X-ray as the gold standard	Conservative therapy based on radiographic findings	Standard knee imaging in the emergency department	International narrative review	AP weight-bearing X-ray is the gold standard for identifying OA features, including joint space narrowing, osteophytes, and subchondral sclerosis.
14.	Belton et al., 2025	Patellofemoral osteoarthritis	Skyline and lateral X-ray views	Patellofemoral physiotherapy and patient education	Skyline view is essential for patellar assessment in the emergency department	Open-access / original research	Patellofemoral osteoarthritis is optimally evaluated using skyline and lateral X-ray views, which demonstrate patellofemoral joint space narrowing and osteophyte formation along the patellar margins.
15.	Hidayati PH, 2023	Degenerative OA in the Indonesian population	AP X-ray for assessment of joint space narrowing (JSN)	NSAID therapy and patient education	Rapid diagnosis in geriatric patients in the emergency department	Faculty of Medicine Journal, UMI	P X-ray in the Indonesian population demonstrates typical OA features, including medial compartment joint space narrowing and tibiofemoral osteophyte formation.
16.	Putra, 2024	OA associated with excessive mechanical load	AP X-ray for Kellgren–Lawrence grading	Conservative management	Used in the emergency department for non-traumatic knee pain	WHJ UMI	AP radiographic findings show an association between excessive load and KL grade through subchondral thickening and medial compartment deformity

No.	Source (Author, Year)	Topic/Etiology of Knee OA	Initial Diagnosis (Radiography/Technique)	Initial Intervention Based on Radiographic Findings	ED / ICU Relevance	Journal Type/Access	Conclusion
17.	Setiyani, 2023	Degenerative OA and pain intensity (VAS)	AP X-ray to evaluate joint deformities	Conservative therapy	X-ray guides initial analgesic administration in the emergency department	National proceedings / journal	AP X-ray assists in identifying OA-related joint deformities, such as varus–valgus alignment and joint space narrowing, which guide severity assessment.
18.	Aisyah AAN et al., 2025	OA related to aging and obesity	AP X-ray demonstrating degenerative changes	NSAIDs, weight control, and physiotherapy	Differentiation between OA and acute injury in the emergency department	HTJ, Faculty of Medicine, Untad	AP X-ray clearly demonstrates age- and obesity-related degenerative changes through the presence of marginal osteophytes and medial compartment joint space narrowing of the knee.
19.	Saputri SM., 2024 (Universitas Awal Bros, thesis)	Radiographic techniques for knee OA	AP weight-bearing, skyline, and lateral X-ray views	Optimization of radiographic technique to improve diagnostic accuracy	Useful in the emergency radiology unit for accurate diagnosis	Undergraduate thesis / institutional repository (open access)	Optimization of radiographic techniques (AP weight-bearing, skyline, and lateral views) enhances visualization of OA features such as patellofemoral osteophytes, joint space narrowing (JSN), and subchondral sclerosis.
20.	Ruhyana L. et al., 2024 (National journal / Bit-Tech)	Degenerative knee osteoarthritis	X-ray as confirmation of OA diagnosis	Initial intervention based on X-ray findings	Useful for ICU patients with limited mobility	National journal / open access (R&D article)	AP X-ray findings in knee OA demonstrate joint space narrowing and osteophyte formation, serving as the basis for diagnostic confirmation even in ICU patients with positioning limitations.

Discussion

The Role of Convention Radiography as a First-Line Examination

Based on the summary of the 20 articles presented in the results table, it can be concluded that conventional radiography remains the primary imaging modality and the first-line examination for the diagnosis of knee osteoarthritis (OA), particularly through anteroposterior (AP) weight-bearing, lateral, and, in certain conditions, skyline views.



Figure 2. Anteroposterior and lateral radiographs of the left knee. The images demonstrate grade 4 knee osteoarthritis, characterized by medial and lateral joint space narrowing, multiple large osteophytes involving the femoral and tibial condyles, and subchondral sclerosis. The lateral projection reveals posterior osteophytes and irregular joint contours, consistent with advanced-stage osteoarthritis.

Several studies emphasize that the use of weight-bearing projections provides higher sensitivity for detecting joint space narrowing compared to non-weight-bearing examinations. This is consistent with the findings of Piccolo et al. (2023) and Shinde et al. (2024), who reported that structural changes in osteoarthritis become more apparent when the joint is subjected to physiological loading.

Conventional plain radiography continues to be recognized as the primary initial imaging modality when knee osteoarthritis is suspected. This position is maintained due to several practical and diagnostic advantages, including its wide availability, relatively low cost, short examination time, and ability to demonstrate characteristic osseous structural changes. These radiographic features include osteophyte formation, joint space narrowing, subchondral sclerosis, and the presence of subchondral cysts, as reported by Piccolo et al. (2023).

Furthermore, the results of both review articles and original studies analyzed in this literature review indicate that the use of an anteroposterior (AP) weight-bearing projection combined with lateral views, and supplemented by skyline projections when patellofemoral compartment involvement is suspected, provides improved sensitivity in identifying joint space narrowing and load distribution patterns within the knee joint. The consistency of these findings is evident across studies by Piccolo et al. (2023), Shinde et al. (2024), and Saputri (2024).

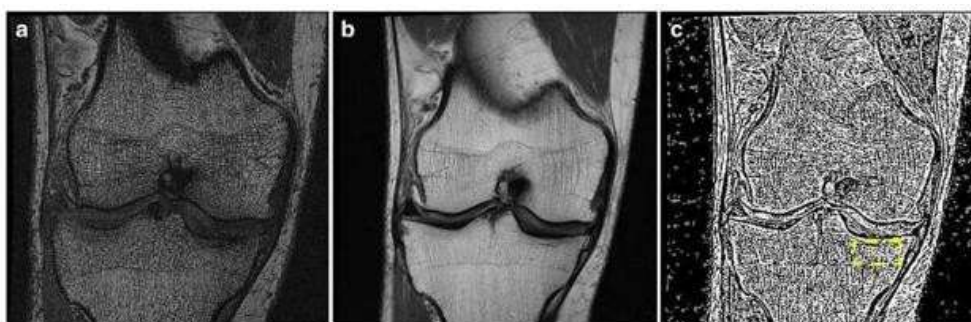


Figure 3. (a) Magnetic resonance imaging (MRI) using a 3D-FISP sequence, producing high-contrast anatomical images that allow clear visualization of tissue structures. (b) MRI performed with intermediate-weighted sequences, such as T1-weighted imaging (T1WI), T2-weighted imaging (T2WI), or proton density fat-suppressed (PD-FS) sequences, providing moderate contrast and facilitating evaluation of soft tissue characteristics. (c) MRI images obtained using T1WI/T2WI/PD-FS sequences that were subsequently binarized to enhance the delineation of boundaries and specific structures within the image.

In the figure above, the yellow rectangular area indicates the region of interest used for determining subchondral bone biomarkers derived from conventional intermediate-weighted magnetic resonance imaging sequences. These biomarkers include trabecular thickness, trabecular separation, connectivity density, and the bone volume-to-total volume ratio. This image was adapted from a previous study.

Overall, the reviewed literature consistently emphasizes that the appropriate selection and application of radiographic techniques, including the use of weight-bearing positioning, are essential prerequisites for achieving accurate and clinically reliable radiographic interpretation.

Characteristic Radiographic Findings and Grading System

The most frequently observed radiographic findings in knee osteoarthritis include joint space narrowing, marginal osteophyte formation, subchondral sclerosis, and subchondral cysts. These features serve as the primary indicators for assessing disease severity using the Kellgren–Lawrence (K–L) grading scale. The use of the K–L system as the basis for radiological evaluation was consistently reported across nearly all articles included in the results table, such as studies by Shinde (2024), Setiyani (2023), and Putra (2024), which examined the relationship between radiographic grading and patient-reported pain severity.

The Kellgren–Lawrence classification for tibiofemoral joint osteoarthritis is defined as follows:

- a. Grade 0: No radiographic features of osteoarthritis
- b. Grade 1: Small osteophytes of doubtful clinical significance
- c. Grade 2: Definite osteophytes with preserved joint space
- d. Grade 3: Definite osteophytes with moderate joint space narrowing
- e. Grade 4: Definite osteophytes with severe joint space narrowing and subchondral sclerosis



Figure 4. In Grade 0, no radiographic signs of osteoarthritis are observed. Grade 1 is characterized by the presence of very small osteophytes with uncertain clinical significance. In Grade 2, osteophytes are clearly visible, while the joint space remains preserved. Grade 3 demonstrates more evident joint space narrowing, indicating progressive structural involvement. In Grade 4, there is marked reduction of the joint space accompanied by subchondral sclerosis, reflecting advanced joint degeneration.

In radiographic examination, several characteristic findings are commonly used to diagnose knee osteoarthritis (OA). The main radiographic features that are typically evaluated include:

- a. Osteophytes, which are spur-like bony outgrowths that develop at the joint margins and represent one of the classic radiographic signs of OA.
- b. Joint space narrowing (JSN), which serves as an indirect indicator of cartilage loss. Although articular cartilage cannot be directly visualized on plain radiographs, a reduction in joint space width reflects decreased cartilage thickness resulting from degenerative processes.
- c. Subchondral sclerosis, referring to increased bone density or thickening of the bone beneath the cartilage surface as a response to ongoing cartilage degeneration.
- d. Subchondral cysts and articular deformities, which are typically observed in advanced stages of OA and indicate more severe structural changes affecting the bone and joint.



Figure 5. Normal and Osteoarthritis (OA) Knee X-ray Imagery

These findings constitute an essential basis for the diagnosis and assessment of OA progression, with each feature providing clinical insight into the extent of joint damage.

For radiographic classification purposes, the Kellgren–Lawrence (K–L) grading system remains the most widely used method in both clinical and epidemiological studies, primarily due to its ease of application and the extensive availability of historical data that allow for inter-study comparisons. Consequently, the K–L system is considered a practical and reliable tool in many research settings (Shinde et al., 2024; Pi et al., 2023).

Nevertheless, despite its widespread use, the K–L system places greater emphasis on osteophyte formation and joint space narrowing (JSN) as the main assessment parameters, which reflect structural changes within the joint. However, several limitations must be acknowledged. One notable limitation is inter-observer variability, which may lead to differences in interpretation among radiologists. In addition, the K–L system has limited sensitivity for detecting early OA changes, particularly those related to cartilage damage, which are often difficult to identify on conventional radiographs in the early stages of the disease (Shinde, 2024).

Limitations of Radiography and the Role of Complementary Modalities (MRI, US)

Conventional radiography is superior for assessing osseous structures but has limited sensitivity for detecting early cartilage changes, synovitis, and bone marrow lesions (BMLs), which are often associated with pain severity and disease progression. Therefore:

- a. Magnetic Resonance Imaging (MRI) is recommended when soft tissue abnormalities are suspected, when patients present with severe pain disproportionate to radiographic findings, or when further evaluation is required to guide advanced interventions. MRI provides superior detection of cartilage damage, BMLs, and synovitis compared to radiography (Piccolo et al., 2023).

- b. Ultrasound (US) has emerged as an increasingly valuable complementary modality for identifying joint effusion, synovitis, and small erosions on the articular surface, as well as for guiding intra-articular aspiration and injections. Its portability and real-time imaging capability make US particularly practical in emergency department (ED) and intensive care unit (ICU) settings (D'Agostino et al., 2024). Recent studies have demonstrated correlations between US findings and selected radiographic or MRI features, as well as with pain and functional scores in specific clinical contexts.

Clinical Implications for the Emergency Department and Intensive Care Unit

Radiography plays a crucial role in clinical practice, particularly in the Emergency Department (ED) and Intensive Care Unit (ICU) settings. In the ED, knee radiography is commonly used as a rapid evaluation tool to differentiate chronic osteoarthritis from acute conditions such as fractures, dislocations, septic arthritis, or high-energy traumatic injuries. Radiographic assessment assists in determining clinical priorities, especially in geriatric patients presenting with severe joint pain, limited mobility, and an increased risk of falls. In emergency situations, radiography also supports early clinical decision-making related to pain management, immobilization, and referral to orthopedic services.

Portable radiography in the ICU is highly beneficial for unstable patients or those who cannot be safely transported, such as individuals after major surgery, with multiple trauma, or with severe systemic conditions. Bedside imaging allows musculoskeletal assessment without exposing patients to the risk of physiological deterioration associated with transport. Furthermore, the integration of radiography with AI-based automated image analysis may accelerate image interpretation and reduce the workload of radiology personnel in high-volume healthcare facilities, thereby expediting clinical decision-making. In the ED, AI systems for detecting OA features or joint space narrowing also have the potential to function as triage tools to determine the urgency of intervention or specialist referral.

Thus, although osteoarthritis is a chronic condition, radiography retains significant clinical value in emergency settings as a rapid assessment tool for acute joint pain, exclusion of life-threatening diagnoses, and guidance for initial management, including conservative treatment, interventional procedures, or specialist referral

4. Conclusion

Based on the review of twenty studies, conventional X-ray radiography particularly the anteroposterior (AP) weight-bearing projection remains the primary modality for assessing knee osteoarthritis due to its consistent ability to demonstrate characteristic structural features of OA. The most frequently reported radiographic findings include joint space narrowing (JSN), marginal osteophyte formation, subchondral sclerosis, and joint contour deformities such as varus or valgus alignment. In cases of patellofemoral osteoarthritis, skyline and lateral projections are considered the most accurate techniques for visualizing patellofemoral joint changes. The literature also highlights that image acquisition quality substantially influences interpretive accuracy, emphasizing that the use of weight-bearing positions and combined projections is essential for optimal visualization of OA-related changes. Furthermore, advancements in imaging analysis technologies such as artificial intelligence (AI), convolutional neural networks (CNNs), and radiomics analysis have improved the consistency of radiographic assessment, particularly in determining Kellgren–Lawrence grading and detecting early OA changes that may not yet be visually apparent. Clinically, X-ray imaging remains highly relevant for rapid screening in emergency department (ED) settings, as it enables differentiation between chronic osteoarthritis and acute injuries and provides a foundation for early clinical decision-making, including conservative management, patient education, weight control

strategies, and referral to orthopedic specialists. Overall, the reviewed literature consistently confirms that radiography remains the key examination and gold standard for initial diagnosis and assessment of disease progression in knee osteoarthritis.

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